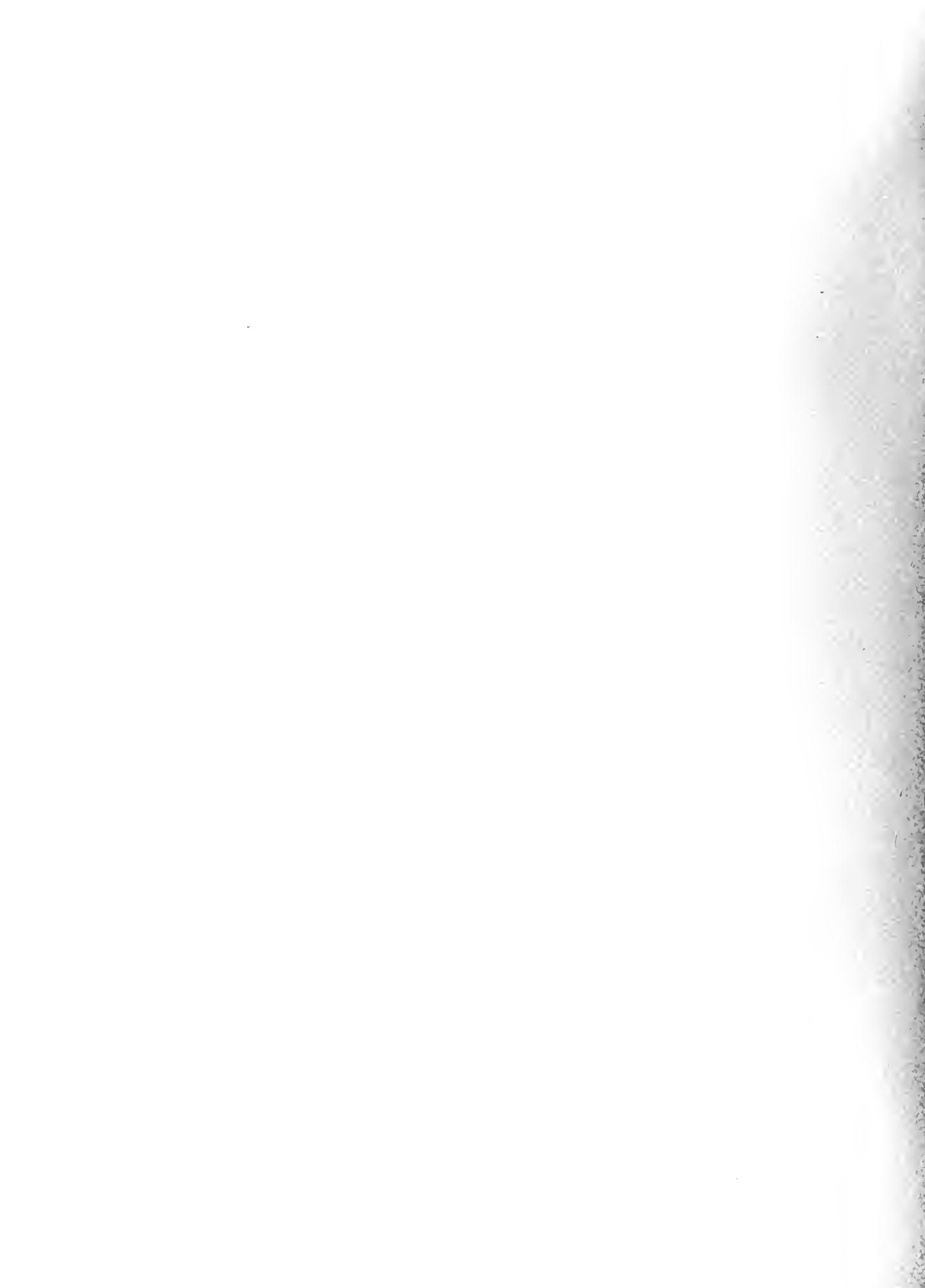




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Toward a Descriptive Model of  
Post-Implementation Evaluation

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## Toward a Descriptive Model of Post-Implementation Evaluation

### Abstract

Strategies for evaluating computer-based information systems (CBISs) recommended in the information systems (IS) literature are generally based upon formal, quantitative models of evaluation. However, evidence suggests that IS professionals frequently omit formal, quantitative evaluation of CBISs and rely instead on informal, qualitative evaluation. If formal, quantitative models of CBIS evaluation are of value, why are they infrequently used by their intended beneficiaries?

Distinguishing between uncertainty and equivocality provides insight into why IS professionals might omit formal, quantitative evaluation. Uncertainty is the absence of information, while equivocality is information that is unclear, conflicting or paradoxical. Evaluation designed to reduce uncertainty uses formal processes and methods, defined organizational roles and responsibilities, quantifiable criterion, and objective data. Evaluation designed to reduce equivocality uses informal processes and methods, negotiated roles and responsibilities, qualitative criterion, and subjective data. One explanation why IS professionals frequently omit formal, quantitative evaluation of CBIS may be that such procedures are not helpful in reducing equivocality.

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## Toward a Descriptive Model of Post-Implementation Evaluation

An organization implements a computer-based information system (CBIS). Later, someone asks if the CBIS is a success or failure. Does it contribute to organizational goals? Should it be maintained, expanded, replaced, or abandoned?

Evidence suggests that the inability to measure and evaluate productivity gains is a major obstacle to investment in CBISs (Blacker and Brown, 1988; Strassman, 1985). Controversy over measuring productivity contributions from new technology has resulted in increasing skepticism regarding the benefits of CBISs (Bowen, 1986; Business Week, 1988). One approach to understanding the controversy over productivity measurement is to reexamine the methods and assumptions of existing CBIS evaluation models.

Researchers have long recognized the importance and complexity of evaluating CBISs. As a result, a number of formal, quantitative methods for evaluating CBISs have been suggested (e.g., King and Schrems, 1978; King and Epstein, 1983; Piepta and Anderson, 1987; Schwuchow, 1977). However, evidence suggests that formal, quantitative methods (e.g., cost-benefit analysis) for evaluating CBISs are relatively infrequently used (Greiner, Leitch, and Barnes, 1979; Hogue and Watson, 1984), and are considered of dubious value by many information systems (IS) researchers and practitioners (Keen, 1981; Hirschheim and Smithson, 1988; Zmud and Apple, 1989). The schism between the recommendations for evaluation found in the IS literature and descriptions of evaluation practice suggests an obvious question. If formal, quantitative methods for CBIS evaluation are of value, why are they infrequently used by their intended beneficiaries? This purpose of this paper is to develop a model that provides insight into this and related questions.

CBIS evaluation is herein defined as the process of determining how a CBIS impacts and is impacted by an organization. Several assumptions are implicit in this definition. First, that a CBIS has been implemented, meaning that evaluation is a post-implementation activity. Evaluation is therefore identified as distinct from feasibility analysis (e.g., Caddell, 1985) and *a priori* justification of CBISs (e.g., Bozcan, 1983). Second, it is assumed that organizations both create and are created by CBISs (Markus, 1984). Evidence suggests that implementing a CBIS can trigger complex, often unanticipated chains of events in organizations (Barley, 1986; Markus and Robey, 1988). These chains of events ultimately mean that organizations shape and are shaped by CBISs. Finally, it is assumed that evaluation can be either formal (e.g. cost-benefit analysis) or informal (e.g. a conversation between two IS managers over lunch). Relaxing the typical definition of evaluation as a formal, quantitative process permits building a more descriptive framework that recognizes both planned and unplanned, and formal and informal evaluation.

This paper develops a model that explains why IS professionals frequently omit formal, quantitative CBIS evaluation, relying instead on less formal, qualitative methods. The presentation of this model is organized as follows. First, uncertainty is distinguished from equivocality, and expected differences in uncertainty-reducing and equivocality-reducing CBIS evaluation are identified. Second, a descriptive, contingency model of CBIS evaluation is proposed that relates the usefulness of uncertainty and equivocality-reducing evaluation to relationships between organizational actors. The paper concludes with a discussion of the implications of the model for CBIS evaluation research.

## **Uncertainty and Equivocality-Reducing CBIS Evaluation**

### *Uncertainty and Equivocality*

A useful dichotomy in considering CBIS evaluation is the distinction between uncertainty and equivocality. Uncertainty is the absence of information (Miller and Frick, 1949; Daft and Lengel, 1986). As information increases, uncertainty decreases. The game of 20 questions illustrates uncertainty and uncertainty reduction. A questioner receives yes-no answers to questions intended to identify an unknown object as either animal, vegetable, or mineral (Taylor and Faust, 1952; Bendig, 1953; Daft and Lengel 1986). Uncertainty is eliminated when the object is correctly identified. In management tasks characterized by uncertainty, managers are able to ask questions, and get answers that permit problem solving. Organizational processes can be structured to reduce uncertainty through the use of rules and regulations and through the creation of formal, structured IS (Daft and Lengel, 1986).

In contrast, equivocality involves interpreting data that is unclear, conflicting, or paradoxical (Daft and Macintosh, 1981; Weick, 1979). The sentence, "I saw the man on the hill with the telescope," (Simon, 1982, p. 93) is equivocal: multiple interpretations are possible. Do I have the telescope, or does the man on the hill? Is the telescope merely on the hill and not in the man's hand? Managers deal with 'men on hills with telescopes' regularly, and must make sense of such equivocality. Daft, Lengel, and Trevino (1987, p. 357) observe that in equivocal environments, "Managers are not certain what questions to ask, and if questions are posed there is no store of objective data to provide an answer."

Fundamental to the process of managing equivocality is "sense-making," which involves exchanges between managers intended to reduce equivocality and create a shared interpretation that can direct future events (Weick, 1979). When facing equivocality, managers build a shared interpretation, and "enact" a solution, rather than relying on data gathering activities to direct events (Daft and Weick, 1984). The processes of sense-making and enactment involve exchanging subjective opinions, managing multiple perspectives, and proactively shaping environments

(Smircich and Stubbart, 1985). Equivocality is reduced by managing and generating both events and interpretations of events.

### *CBIS Evaluation as Uncertainty-reducing Activity*

Approaches to CBIS evaluation contain underlying assumptions as to whether evaluation processes should be designed primarily to reduce uncertainty or equivocality. Existing research on assessing CBIS impact generally views evaluation as an uncertainty-reducing process based upon formal, objective data collection and information processing (e.g. Hamilton and Chervany, 1981a, 1981b). Viewing CBIS evaluation as a data collection activity leads to an evaluation process focused on gathering and processing data to reduce and eliminate uncertainty about CBIS impact. CBIS evaluation methods based upon formal, objective data collection include cost-benefit analysis (e.g., Emery, 1982; King and Schrems, 1978), user surveys (e.g., Miller and Doyle, 1987; Rushinek and Rushinkek, 1983), measures of computer usage (e.g., Ferrari 1978; Hiltz and Turoff, 1981), and the use of "objective" data sources external to the implementing organization (e.g., Banker and Kauffman, 1988).

Uncertainty-reducing CBIS should be recognizable by the existence of organizational processes oriented towards formal data gathering and information processing. Figure 1 describes organizational processes that should exist when CBIS evaluation is perceived as an uncertainty-reducing activity. In general, uncertainty-reducing CBIS evaluation should rely on formal evaluation processes and procedures, should utilize the defined authority structure of the organization, should rely on quantifiable measures of the system, and should be based upon objective, verifiable data. In addition, CBIS evaluation designed to reduce uncertainty is likely to focus on measuring expected, anticipated effects, rather than exploring unplanned, unexpected effects of CBISs.

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Insert Figure 1 about here

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### *CBIS Evaluation as Equivocality-reducing Activity*

An alternative evaluative perspective is to view assessing IS impact as a sense-making process (Weick, 1985). Viewing CBIS evaluation as sense-making suggests that determining the impact of an information system requires interpreting conflicting, ambiguous information, and may involve building and enacting shared interpretations of events to resolve equivocality. Consequently, CBIS evaluation as sense-making leads to an evaluation process largely focused on exchanging subjective opinions and beliefs, rather than gathering formal, objective data.

Figure 2 describes organizational processes that should exist when CBIS evaluation is conducted as an equivocality-reducing activity. In general, equivocality-reducing CBIS evaluation should rely on informal (rather than planned) meetings and discussions, on negotiated (rather than assigned) roles and responsibilities, on qualitative (rather than quantitative) dimensions of system success, and on subjective (rather than objective) data. In addition, equivocality-reducing CBIS evaluation is more likely to consider unplanned impacts (e.g. changes in social relationships).

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Insert Figure 2 about here  
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## A Model of CBIS Evaluation

When are organizations likely to undertake uncertainty-reducing versus equivocality-reducing CBIS evaluation? Two characteristics that may be useful in predicting the evaluative approach used are: (1) the extent of agreement among organizational actors as to CBIS-related goals, and (2) the extent of agreement as to whether an implemented CBIS achieves system-related goals (i.e., whether the CBIS provides the *means* for achieving goals). The extent of agreement on means and goals is likely to influence the importance of uncertainty-reducing versus equivocality-reducing activites, and to thereby influence CBIS evaluation.

Organizational actors may have differing, conflicting goals with respect to an implemented CBIS (Kling, 1987; Kling, 1980). Actors may value CBISs as a means of achieving functional objectives (e.g., reducing costs), as a symbol of the importance of an individual or group within the organization, or as a signal of commitment to particular organizational ideologies (Feldman and March, 1981; Robey and Markus, 1984). Agreement among actors on goals reduces equivocality, since objectives can be assumed, and need not be constructed through sense-making and enactment processes.

When organizational actors disagree as to CBIS-related goals, equivocality will be high. As organizational actors move towards disagreement on goals, CBIS evaluation will likely move towards equivocality-reducing processes. Consequently, evaluation processes are likely to assume the characteristics of equivocality-reducing evaluation stated in Figure 2.

Actors may also disagree as to whether an implemented CBIS achieves desired goals (i.e., does the CBIS provide the *means* for achieving goals?). For example, actors may agree that reducing costs is desirable, but may disagree as to whether an implemented CBIS has achieved cost savings. Agreement among actors on means for achieving goals (e.g., the system does reduce costs) decreases uncertainty.

When organizational actors disagree on means for achieving CBIS-related goals, uncertainty will be high. As organizational actors move towards disagreement on means, CBIS

evaluation will likely move towards objective data gathering and information processing designed to reduce uncertainty about CBIS impact. Consequently, as organizational actors move toward disagreement on means, evaluation processes are likely to assume the characteristics of uncertainty-reducing evaluation stated in Figure 1.

Figure 3 is a descriptive model of CBIS evaluation that summarizes the hypothesized relationships between agreement on goals and means, and CBIS evaluation processes. When agreement on both goals and means for achieving goals is high (cell 1), evaluation is trivial, since actors agree both as to goals, and as to whether the CBIS achieves agreed-upon goals. When agreement on CBIS-related means is low, but agreement on goals is high (cell 2), uncertainty will be high, and evaluation will be constructed primarily to reduce uncertainty, resulting in formal, quantitative evaluation. When agreement on CBIS-related goals is low, but agreement on means is high (cell 3), equivocality will be high, and evaluation will be undertaken to reduce equivocality, resulting in informal, qualitative evaluation. When agreement on both goals and means is low (cell 4), uncertainty and equivocality are high, and CBIS evaluation is likely to employ both uncertainty-reducing and equivocality-reducing evaluation processes. In such cases, evaluation is likely to employ both formal and informal processes, defined and negotiated roles and responsibilities, and qualitative and quantitative criteria.

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Insert Figure 3 about here

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## Discussion and Conclusion

Most existing research views CBIS evaluation as an uncertainty-reducing activity. However, such a perspective does not explain the infrequent use of formal data collection activities evidenced in surveys of evaluation practice. One explanation why IS professionals often omit formal CBIS evaluation and rely instead on informal, subjective interpretations of system impact may be that formal CBIS evaluation is of little value in reducing equivocality.

Ultimately, the goal of investigating CBIS evaluation is to offer prescriptions for improving productivity measurement. However, existing methods for evaluating CBISs largely ignore evaluation as an equivocality-reducing process. The intent of this paper is to legitimize informal, unplanned, equivocality-reducing evaluation, by recognizing that informal evaluation may be of greater value than formal evaluation under certain circumstances. Ideally, legitimizing equivocality-reducing evaluation will lead to normative and prescriptive evaluation approaches that take seriously the subjective, informal, impressionistic evaluations considered largely irrelevant and uninformative by previous CBIS evaluation research.

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## **Figure 1**

### **Characteristics of Uncertainty-reducing CBIS Evaluation**

- \* Emphasis on formal processes and formal evaluation, e.g. formal reports, formal meetings.
- \* Use of formal, defined organizational authority structure to manage evaluation, e.g. official titles and roles.
- \* Emphasis on quantifiable and directly measurable aspects of system, e.g. costs, system usage, etc..
- \* Use of objective, verifiable data sources and methods, e.g. user surveys, cost-benefit analysis, system logs, etc..
- \* Emphasis on planned CBIS impact, e.g. cost savings, administrative convenience.

## **Figure 2**

### **Characteristics of Equivocality-reducing CBIS Evaluation**

- \* Emphasis on unplanned processes and informal evaluation, e.g. unplanned meetings, informal discussion.
- \* Use of informal organizational authority structure to manage evaluation, e.g. negotiation of roles and responsibilities.
- \* Use of subjective opinions, impressionistic "evidence" and experiential, interpretive "methods," e.g. in-depth interviews, systematic reflection.
- \* Consideration of unplanned CBIS impact, e.g. social relationships, unexpected consequences.

**Figure 3**  
**A Descriptive Model of CBIS Evaluation**

		Agreement on Means	
		High	Low
		Cell 1 equivocality: low uncertainty: low evaluation : trivial	Cell 2 equivocality: low uncertainty: high evaluation: uncertainty-reducing
Agreement on Goals	High		
	Low	Cell 3 equivocality: high uncertainty: low evaluation: equivocality-reducing	Cell 4 equivocality: high uncertainty: high evaluation: equivocality and uncertainty-reducing











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